Solar wind disturbances observed by Doppler scintillation measurements and coronal mass ejections

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Many Doppler scintillation transients, characterized by scintillation enhancements and representing solar wind disturbances, have been observed near the sun, where significant solar wind evolution has not yet taken place. A comparison of the frequency of occurrence of these Doppler scintillation transients with that of coronal mass ejections (CMEs) has shown that there is a close relationship between both radio and optical phenomena (Woo, JGR, 98, 18999, 1993).

In this paper we investigate this relationship in more detail based on comparisons of individual events during the period of 1979-1984. We find that essentially all CMEs show up as scintillation transients near the sun whenever radially aligned scintillation measurements are available. The speeds of the CMEs estimated from the transit times between CME and radio scintillation detection are consistent with those estimated for the CMEs from time lapse coronagraph pictures.

A striking contrast is apparent when high (1981) and low (1984) solar activity periods are compared. During 1981, the CMEs tend to be fast, bright and important as classified in Howard et al. (JGR, 90, 8173, 1985); while the corresponding Doppler scintillation transients show large factors of scintillation enhancement and usually represent interplanetary shocks. During 1984, the CMEs tend to be slow-moving and classified as not significant in terms of intensity and importance, while the scintillation transients exhibit small factors of scintillation enhancement. These results support the notion that CMEs play a role in the large compressive fluctuations observed by in situ plasma measurements in the slow solar wind at 0.3 AU during solar minimum conditions (Marsch and Tu, JGR, 25., 11945, 1990).

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